

A DINOSAUR TRACKWAY FROM THE PURBECK BEDS OF SWANAGE, ENGLAND

by

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(Paper presented at Fifth Conference of the Palaeontological Society of Southern Africa, Graaff-Reinet, September 1988)

ABSTRACT

During 1962 a dinosaur trackway was unearthed in a quarry of Upper Jurassic/Lower Cretaceous building-stone at Langton Maltravers near Swanage. The primary tracks had been removed initially but secondary impressions were still visible and these were marked with black paint. It was concluded that the prints were made by a tridactyl bipedal species of dinosaur, probably of megalosaurian type. A quantity of overburden covered part of the trackway and it was arranged for this to be removed so that the primary tracks could be collected. The trackway, which was 22 metres long as preserved, showed a somewhat sinuous gait of a true biped with no tail-drag and only occasional evidence of what may have been front foot impressions. Two individuals had made the footprints, walking on a similar course about one metre apart. The tracks of these two were collected, as was a third trackway which went off at an angle to the right. Above the stratum containing the prints was another layer which contained prints of an undoubted iguanodontid type.

INTRODUCTION

Three-toed dinosaurian footprints have long been a common occurrence in the Purbeck stone quarries (fig. 1); in fact, the rustic quarrymen of yore on unearthing these prints, used to remark, "*He has passed this way*". Previously only isolated prints had been found, but during October 1961 a continuous series of tracks was unearthed in the quarry of Messrs J and E W Suttle at Herston near Swanage. The area was formally known as Mutton Hole and had only recently been opened up again for quarrying. The building stone in which these prints were found is known locally as the "roach" or "pink" bed. The boundary between the Lower Cretaceous and the Upper Jurassic lies between the upper and lower roach stone; the tracks occurred in the upper Roach (fig. 2).

HISTORICAL BACKGROUND

In January 1962 Mr E W Suttle, along with three local amateur geologists, Messrs P A Brown, E F Oppe and H J White, prepared a diagram of the main trackway. It consisted of a double line of 26 prints, disposed either side of a mid-line. Their interpretation was that the footprints were of an iguanodontid and that the two rows represented successive left and right foot impressions of one individual. A copy of their diagram was sent to the Department of Palaeontology at the British Museum (Natural History) (BMNH) in London. Dr Alan Charig, then Curator of Fossil Reptiles at the BMNH, travelled to Swanage in late January 1962 to examine the trackway. By this time the roach stone containing the primary prints had been quarried away, leaving only the secondary impressions of the prints in the fissile "cinder bed" beneath. The weather was bad at the time and the continuous rain had reduced the quarry floor to a muddy surface, making it most difficult to see the prints.

A third set of prints forming a single line had come to light subsequent to the first exposure but was not easily seen under the circumstances and their significance was not immediately appreciated.

The following March, the author and C A Walker of the BMNH investigated the prints under dry conditions. The "double" prints were painted black and when viewed from the 11 metre high overburden cliff it could be seen that in all likelihood the two lines of prints represented two individuals walking close together in the same direction. The third trackway, evidently made by a single individual, was then also painted (fig. 3). The footprints disappeared under the overburden, which at this point jutted out into the quarry surface as a wedge, and re-emerged beyond it. After consultation with M J Suttle, he generously offered to defray the cost of removing the 11 metre overburden to expose the underlying trackway, which involved removal of several hundred tons of rubble. In order to protect the prints from damage by the heavy lorries passing over them to and from loading rubble, it was decided to leave the upper roach stone in situ until all the rubble was removed.

This upper layer was afterwards removed by hand and the prints exposed ready for collecting (fig. 4). At this stage of the recovery there was a good deal of reluctance on the part of some of the local amateurs to accept that the "double" trackway in fact represented two individuals, and removal of the overburden was eagerly awaited to see what it would reveal.

COLLECTING

In June 1963, a party from the BMNH, consisting of P Whybrow, J Fergusson and R Rickson, under the leadership of the author, commenced removal of the slabs. In this task they were assisted by Mr E W Suttle, who supervised the lifting of the stone, and his staff.

When the upper roach stone layer was removed it revealed a continuous trackway comprising two lines of prints with some 26 impressions in each row and extending for some 22 metres (fig. 5).

The trackway was broken up into separate slabs by natural cracking in the stone (fig. 6), and these were mapped in situ before removal. Each slab was given a number painted in black on a white circle, and covered with a clear resin varnish to protect it against the weather – which, to begin with, was fortunately dry. Shortly after lifting operations began the weather broke and conditions were almost continually wet from then on. An impervious iron-stone band in the overburden retarded the drainage of water so that gradual seepage meant that the single trackway ended up lying under several inches of water for some days. Eventually the retaining layer was located and breached to allow the water to drain away and the trackway to dry off.

Before being lifted the prints were photographed and measured. As there was no power in the quarry, all lifting was carried out by driving a cold steel wedge into the cleavage plane and then prizing the slab up with a crowbar. The slabs were then man-handled to the side of the quarry and stacked ready for loading; the muddy quarry floor and the viscous mud lining the undersurface of each slab made this a somewhat hazardous job. The slabs were then loaded onto the lorry as nearly as possible in the order in which they came up.

On reaching the BMNH they were offloaded and laid down on the lawn in front of the museum to dry thoroughly and to be cleaned before being placed in storage. In all, some 38 tons of rock were lifted, 18 of which comprised the trackway slabs which were brought back to the museum.

DISCUSSION

When the upper roach was removed and the primary tracks exposed, it immediately became apparent that each successive print in each row differed from the preceding one in its morphology in that each displayed left or right characteristics. Most noticeable was the hooked inner digit, as opposed to the longer, straight and tapering outer digit. The marked contrast between the inner and outer digits, alternating with each successive print, was proof positive that each row of the “double” trackway was made by an individual dinosaur (fig. 7).

Each footprint measured 300 mm from the tip of the middle digit to the “heel” (=distal end of the metapodium) and 350 mm across the greatest width. The pace, as measured from the tip of one central digit to that of the succeeding footprint was variable between 600 mm and 720 mm. The stride had a maximum of 1 442 mm. The stride in proportion to the size of the prints would seem small. This could be an indication of slow movement and might possibly tell something of the restricted nature of the bird-like gait.

The somewhat sinuous nature of the trackway, in which the prints are only slightly offset from a mid-line, is reminiscent of modern flightless birds. Even smaller birds such as seagulls show a similar sinuous nature in their tracks (fig. 8). One strange feature was the occurrence of thirteen indentations of a similar shape adjacent to the hind prints. In every case the distance from the hind print was almost the same. These could well be fore-limb impressions (fig. 9).

The lack of any evidence of tail drag indicates that the animal probably carried its trunk closer to the horizontal than the vertical, and hence the occasional dabbling of the fore-paws on the ground. This creature was an undoubted biped.

CONCLUSION

The majority of the footprints exposed at the Swanage quarries in the past have been of lobed iguanodontid type; indeed, a set of six such prints was exposed in the upper roach stone during the preliminary operations to uncover the main trackway reported here. They were painted and recorded by Alan Charig (who was present for the preliminary investigations before departing for Africa), and these were also collected and taken to London (fig. 10).

The three animals which made the tracks described here are thought to have been of “megalosaurian” type (large bipedal theropods).

This is one of the longest continuous dinosaurian trackways yet collected in Western Europe and clearly demonstrates the undoubted total bipedalism of megalosaurians. The very bird-like gait perhaps underlines the fact that these animals were not able to move at great speed – except possibly under duress. From the footprint dimensions it may be speculated that they were made by animals that stood some 1.75 m high at the hips. The author’s impression as to the walking posture of these animals is shown in Figure 11.

ACKNOWLEDGEMENTS

As noted above, John Suttle donated the cost of removing the overburden to expose the trackway. The cost of lifting the prints and their transportation back to London was born by the sister of Dr C T Trechman. As a result of the goodwill generated by Dr W E Swinton when he was Curator at the BMNH, Dr Trechman had on many occasions provided funds. He put up the money for the purchase of the *Tyrannosaurus* skeleton now exhibited in the dinosaur gallery of the museum and in front of which the Swanage “double” trackway was eventually laid down.



Figure 1. Dinosaur footprints have long been known from the Swanage district quarries and may be seen in many gardens around the town. Here a local inn-keeper displays an iguanodont footprint with an ammonite.



Figure 3. Cyril Walker with the "double" black-painted trackway. The single line of footprints can be seen in the upper left of the picture.



Figure 5. The trackway as revealed when the overburden was removed.

WEALDEN		
		LOWER CRETACEOUS
UPPER ROACH BUILDING STONE	<i>Iguanodon</i> prints horizon <i>Megalosaurus</i> prints horizon	
CINDER BED		
LOWER ROACH BUILDING STONE		UPPER JURASSIC
MAMMAL BED		

Figure 2. Diagram of the stratigraphical relationships in the quarry in which the footprints occurred.



Figure 4. A channel was cut through the overburden to expose the trackway. A portion of the stone that was left in situ to protect the underlying prints from the lorries may be seen at the far end of the channel.



Figure 6. The natural cracking of the stone into slabs.

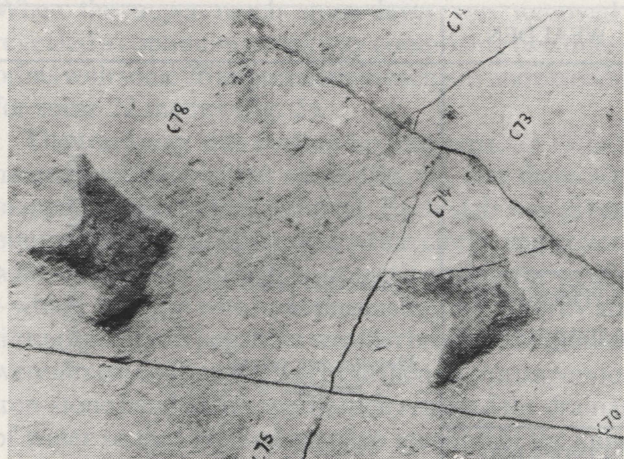


Figure 7. Succeeding left and right footprints clearly showing the hooked inner digit and the longer tapering outer digit alternating.



Figure 9. Two of the indentations that occurred thirteen times adjacent to a hind print, and thought to be manus impressions.

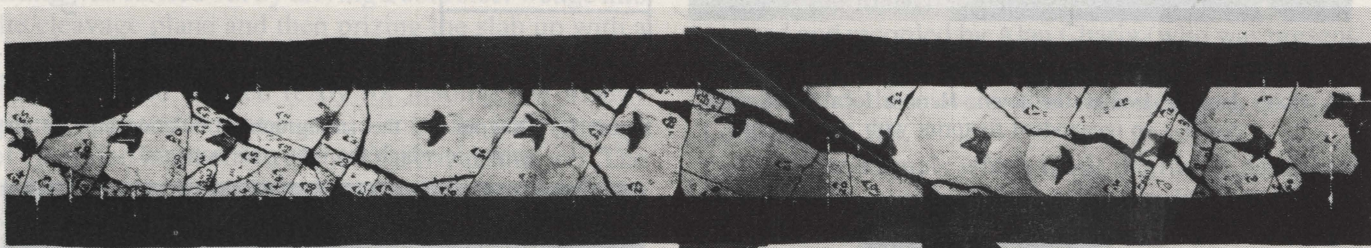


Figure 8. The single megalosaurian trackway showing clearly the sinuous bird-like gait.

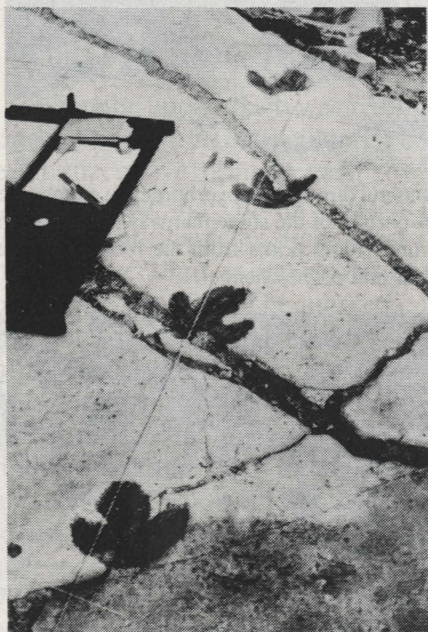


Figure 10. The set of iguanodontid prints.

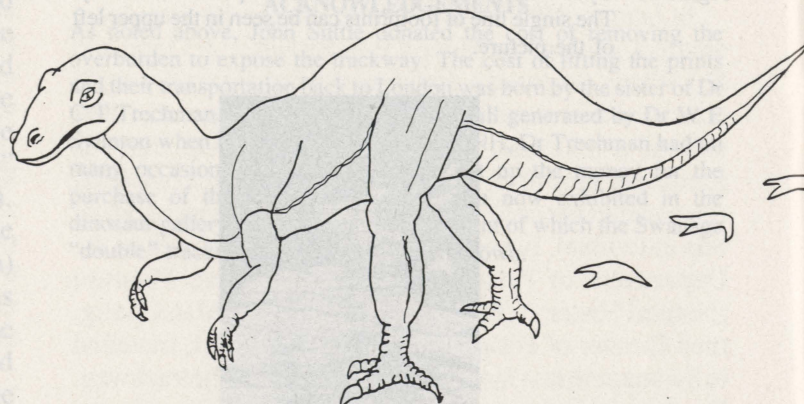


Figure 11. The author's reconstruction of how the animal which made the megalosaurian trackway may have walked.